STATE OF CALIFORNIA

MONITORING & LABORATORY DIVISION

QUALITY ASSURANCE SECTION

VOLUME V

AUDIT PROCEDURES MANUAL FOR AIR QUALITY MONITORING

APPENDIX F

SYSTEM AUDIT PROCEDURES FOR ACID DEPOSITION

JANUARY 1988

APPENDIX F

SYSTEM AUDIT PROCEDURES FOR ACID DEPOSITION

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SYSTEMS AUDIT PROCEDURES FOR ACID DEPOSITION PROGRAMS

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.1.0 SYSTEMS AUDIT PROCEDURES FOR ACID DEPOSITION PROGRAMS

F.1.0.1 Introduction - A systems audit is an annual on-site review and inspection of field sites and laboratory operations of an acid deposition monitoring program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of acid deposition data. A systems audit includes an appraisal of the following program areas: network management, field operations, laboratory operations, data management, quality assurance and data reporting. On-site interviews should include a review of the data processing procedure from field acquisition through reporting into the computer system.

The system audit is facilitated by the use of questionnaires designed to provide information about specific portions of the overall program. For example, a questionnaire is available specifically for laboratory operations. This questionnaire deals only with the laboratory portion of the program, while another specific questionnaire deals only with the field site evaluation. These questionnaires can be used together to provide a system audit of the whole program, or can be used individually to provide a system audit on a portion of the program.

F.1.0.2 Preliminary Assessment and Systems Audit Planning - In performing a systems audit of a given agency, the auditor is seeking a complete and accurate picture of that agency's current acid deposition monitoring operations. The Audit Team should perform the on-site inspections and interviews with key program personnel, evaluate some acid deposition monitoring sites operated by the agency, and scrutinize the data processing procedures.

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

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APPENDIX F.1.1

GUIDELINES FOR CONDUCTING SYSTEMS AUDITS

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.1.1 GUIDELINES FOR CONDUCTING SYSTEMS AUDITS

F.1.1.1 Pre-audit Activities - At the beginning of each hydrological year, a tentative schedule for on-site systems audits of the field sites and laboratories should be established. As a part of this scheduling, the auditor should indicate any special requirements such as access to specific areas or observation of specific activities. The auditor should inform the agency that they will receive a questionnaire which is to be completed. Once the completed questionnaire has been returned, it will be reviewed and the audit team will prepare a checklist detailing specific points for discussion with agency personnel.

F.1.1.2 On Site Activities - The audit team should meet initially with the agency's director or his designee to discuss the scope, duration and activities involved with the audit. This should be followed by a meeting with key personnel identified from the completed questionnaires.

Once the audit is completed, the audit team members should meet again with key personnel and with the agency's director or designee to present their findings. This is also the opportunity for the agency to present their disagreements. The audit team should simply state the audit results including an indication of the potential data quality impact.

F.1.1.3 Post-Audit Activities - The preparation of the Systems Audit Report requires the audit team to compare the documented standard operating procedures with the observed accomplishments and deficiencies of the audit findings.

The draft Systems Audit Report is submitted to the audited agency together with a letter thanking agency personnel for their assistance, time, and cooperation. If no written comments are received from the audited agency by the audit team within thirty (30) calendar days from the report date, the report will be formally distributed without further changes.

If the agency has written comments or questions concerning the audit report, they should be reviewed for incorporation into a final report form within thirty (30) days of receipt of the written comment.

The systems audit report should include an executive summary; an introduction; the audit results based on the responses of the questionnaires and on-site observations; a discussion of the interpretation of the audit results; recommendations for improving the program; and a copy of the completed questionnaires.

The audit results should include information on the network size and siting criteria, on the staff and equipment, on the data management system, and on the quality assurance and quality control functions.

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

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APPENDIX F.2.0

CRITERIA FOR EVALUATION

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.2.0 CRITERIA FOR EVALUATION

F.2.0.1 Introduction - A systems audit is normally conducted in three steps. First a questionnaire is sent to the organization prior to the audit visit. The organization should then fill out the questionnaire as completely as possible and return it with sufficient documentation through the use of attachments. Second, the questionnaire is reviewed by the auditor to become familiar with the system operations and to determine any weaknesses and potential problem areas. Third, after the questionnaire has been reviewed, the on-site interviews are scheduled. The preliminary review of the questionnaire serves the purpose of allowing a greater amount of time to be spent on-site examining potential problem areas.

For the field audit, the auditor should interview the site operator. For the laboratory audit, the auditor should interview the laboratory manager, any person who has direct analytical responsibility for precipitation sample analysis, personnel associated with data validation, analysis and reporting, and the person identified by the laboratory manager who has responsibility for quality assurance. The information gathered from these interviews should be complete and up to date and should present an adequate picture of the current and proposed levels of implementation of all quality assurance activities, including internal quality control.

At the audit conclusion an exit interview informs the organization of the audit results and discusses any potential data impacting problems uncovered. During this activity, the auditor also explains the reporting procedures and schedule. The questionnaires described below are general to the systems audit. Other questionnaires specific to the field and laboratory operations evaluation are presented in Sections F.3.0 and F.4.0, respectively.

F.2.0.2 Reporting Organization Homogeneity Checklist - The reporting organization homogeneity checklist is described in Figure F.2.0.1. The checklist is intended for use when a complete system audit is being conducted. The checklist should be completed by the person responsible for the organization's overall program and should be returned to the auditor.

F.2.0.3 Overall Program Operation Questionnaire - The overall program operation questionnaire is described in Figure F.2.0.2. It is intended for use when a complete system audit is being conducted. The questionnaire should be completed by the person responsible for the overall program, and should be returned to the auditor.

F.2.0.4 Other Questionnaires - Figures F.2.0.3 through F.2.0.8 describe the questionnaires for general operation, staffing, network design, network operation, data and record keeping and quality assurance. These questionnaires are intended to cover the management and organizational activities of the program.

REPORTING ORGANIZATION HOMOGENEITY CHECKLIST

	Yes	No
1. Field operations, for all local agencies, conducted by a common team of field operators?	___	___
2. Common calibration facilities are used for all local agencies?	___	___
3. Precision checks performed by common staff for all local agencies?	___	___
4. Accuracy checks performed by common staff for all local agencies?	___	___
5. Data handling follows uniform procedures for all local agencies?	___	___
6. Central data processing facilities used for all reporting?	___	___
7. Traceability of all standards established by one central support laboratory?	___	___
8. One central analytical laboratory handles all analyses for manual methods?	___	___

Figure F.2.0.1

Example of Reporting Organization Homogeneity Checklist

OVERALL PROGRAM OPERATION QUESTIONNAIRE

Questionnaire Completion Date: _____

On-Site Visit Date: _____

Organization Name and Address: _____

_____

_____

Telephone No.: ATTS: _____ Commercial: (____) _____

Person Completing Questionnaire: _____

Position: _____

Telephone No.: (____) _____

Organization Director: _____

Monitoring Supervisor: _____

Quality Assurance Supervisor: _____

On-Site Audit Conducted By: _____

Affiliation of Auditor(s): _____

_____

Persons Present During Entrance Interview: _____

_____

Persons Present During Exit Interview: _____

_____

Figure F.2.0.2

Example of Overall Program Operation Questionnaire

GENERAL OPERATIONS QUESTIONNAIRE

1. How long has the program been operational?

   Number of Sites _____

   Operating Since _____

2. What is the objective of the monitoring program?

   Baseline _____

   Trends _____

   Other _____

3. Provide a current organizational chart indicating each person's participation in the current program.

4. Have the following been prepared (P), approved (A), issued (I), revised (R)?

   Quality Assurance Project Plan _____ Date _____

   Documentation on sites and network _____ Date _____

   Standard Operating Procedures for Field Sampling _____ Date _____

   Standard Operating Procedures for Analytical Lab _____ Date _____

   Laboratory Quality Control Manual _____ Date _____

5. Have the documents listed above been provided to the Quality Assurance Section? Yes _____ No _____ If not attach current copies.

6. Does the program operate in compliance with:

   EPA Protocol? Yes ___ No ___ Comments _____

   NADP Protocol? Yes ___ No ___ Comments _____

   NTN Protocol? Yes ___ No ___ Comments _____

   ARB Protocol? Yes ___ No ___ Comments _____

Figure F.2.0.3

Example of a General Operations Questionnaire

GENERAL OPERATIONS QUESTIONNAIRE
(continued)

Other Protocol? Yes ___ No ___ Comments _____

_____

_____

7. Was the operating protocol derived from any of the above and modified to meet network needs?

   Explain: _____

   _____

   _____

8. Indicate number of sites currently operational as part of network?

   _____

9. Provide a listing of the current sites and the responsible persons.

10. How many of these sites have collocated instrumentation for precipitation measurements? Please list the sites.

    _____

    _____

Figure F.2.0.3

Example of a General Operations Questionnaire
(continued)

STAFFING QUESTIONNAIRE

1. Please include a list of educational background, experience and training for each responsible person identified in the program organization chart.

2. Are the following adequate for the current and proposed program operation?

   Staff Size? Yes ___ No ___ Comment _____

   Organization? Yes ___ No ___ Comment _____

   Staff Qualifications? Yes ___ No ___ Comment _____

   Staff Utilization? Yes ___ No ___ Comment _____

3. Do staff members receive regular and periodic training to maintain and upgrade job skills? Please indicate examples of each responsible individual's training including period and training method (course?, on-the-job?, etc.).

   _____

   _____

4. Please list the publications and periodicals available to the staff for reference.

   _____

   _____

5. Are staff members adequately conversant with appropriate standard operating procedures to carry out job duties?

   Yes ___ No ___ Comment _____

6. Has a staff member been identified as a Quality Assurance officer?

   Yes ___ No ___ Comment _____

   If not, who handles this responsibility? _____ (Name)

   Who does he/she report to? _____ (Name and Title)

Figure F.2.0.4

Example of a Staffing Questionnaire

NETWORK DESIGN QUESTIONNAIRE

1. Are all sites documented according to specified criteria?

   Yes ___ No ___ Comment _____

   Please attach an example of the documentation for one site.

2. Has the network been designed in accordance with stated program objectives? Include a brief description of any siting compromises.

   Yes ___ No ___ Comment _____

3. Is there a written plan describing the overall network?

   Yes ___ No ___ Title _____ Date _____

4. Does the organization have records identifying the status and history of each site? Does it include:

   (a) Some site identification?

   Yes ___ No ___ Comment _____

   (b) Site coordinates and elevation?

   Yes ___ No ___ Comment _____

   (c) Photos or slides, taken to adequately show siting?

   Yes ___ No ___ Comment _____

   (d) Date monitoring initiated?

   Yes ___ No ___ Comment _____

   (e) Model, manufacturer and serial numbers of equipment at the site and sampling schedule?

   Yes ___ No ___ Comment _____

Figure F.2.0.5

Example of a Network Design Questionnaire

NETWORK DESIGN QUESTIONNAIRE
(continued)

(f) Reason for periods of missing data?

Yes ___ No ___ Comment _____

5. Is equipment installed at the sites in accordance with:

(a) Manufacturer's specifications?

Yes ___ No ___ Comment _____

(b) Network guidelines?

Yes ___ No ___ Comment _____

(c) Sound scientific principles?

Yes ___ No ___ Comment _____

6. Does the network design consider:

(a) Access?

Yes ___ No ___ Comment _____

(b) Power availability?

Yes ___ No ___ Comment _____

(c) Potential localized interferences such as closely located sources?

Yes ___ No ___ Comment _____

7. How often are sites visited by the primary operator? _____

8. How often are samples removed? _____

Figure F.2.0.5

Example of a Network Design Questionnaire
(continued)

NETWORK OPERATION QUESTIONNAIRE

1. Is equipment in the network operated in accordance with the organization's standard operating procedures (where such exist)?

   Yes ___ No ___ Comment _____

2. Are the operating procedures compatible with:

   (a) EPA guidelines?

   Yes ___ No ___ Comment _____

   (b) Manufacturer's recommendations?

   Yes ___ No ___ Comment _____

3. Is equipment operated on a (documented) schedule? (Please attach a copy for one site.)

   Yes ___ No ___ Comment _____

4. Are an adequate supply of spare parts and expendables maintained at all sites by the network to minimize downtime?

   Yes ___ No ___ Comment _____

5. Are all sites operated year round? Yes ___ No ___

   Explain schedule: _____

   _____

6. Is a bound logbook maintained at all sites? Yes ___ No ___

   containing records of site visits? Yes ___ No ___

   problems? Yes ___ No ___

   data? Yes ___ No ___

Figure F.2.0.6

Example of a Network Operation Questionnaire

NETWORK OPERATION QUESTIONNAIRE
(continued)

7. Is routine minor maintenance performed regularly at all sites?

   Yes ___ No ___ Comment _____

   By whom? _____
   (Name, position)

8. Does the person performing such maintenance possess (or have access to):

   (a) Standard troubleshooting/maintenance procedures? Yes ___ No ___

   Comment _____

   (b) Instrument manuals?

   Yes ___ No ___ Comment _____

   (c) Other guidance? Explain _____

   _____

9. Indicate which tasks (if any) are included as part of site operation duties?

Task	Frequency
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Figure P.2.0.6

Example of a Network Operation Questionnaire
(continued)

NETWORK OPERATION QUESTIONNAIRE
(continued)

10. Are any measurements made on samples at sites?

Yes ___ No ___ Comment _____

	At Site (Yes/No)	Frequency (Times per Week)	Measurement Device
Conductivity	_____	_____	_____
pH	_____	_____	_____
Precipitation depth	_____	_____	_____
Weight/Volume	_____	_____	_____
Other	_____	_____	_____

(Attach pages as necessary)

11. How are samples shipped to analytical lab? (Please circle appropriate response.)

in buckets	without field measurements	by truck
in bottles	with field measurements	hand delivered
other*		by mail
		other*

*Explain _____

_____

_____

_____

_____

Figure F.2.0.6

Example of a Network Operation Questionnaire
(continued)

DATA AND RECORD KEEPING QUESTIONNAIRE

1. Please indicate data sources and, as necessary, attach example of, or briefly describe, the data format?

   (a) field site/field lab data include:

   rain gauge charts _____

   copies of data sheets_____

   copies of logbooks_____

   other _____

   (b) analytical lab data include:

   analytical results _____

   calibration data _____

   separate QC data _____

   (c) other data source used in conjunction with acid precipitation:

   meteorological data _____

   aerometric data _____

   source emission data _____

2. Are field data checked for reasonableness?

   Yes ___ No ___ Indicate what is checked: _____

   _____

   _____

   _____

Figure F.2.0.7

Example of a Data and Record Keeping Questionnaire

DATA AND RECORD KEEPING QUESTIONNAIRE
(continued)

3. Are analytical lab data checked for reasonableness?

   Yes ___ No ___ Indicate what is checked: _____

   _____

   _____

   _____

4. Are a portion of data from field re-verified by lab (such as duplicate pH, conductivity or weight measurements)?

   Yes ___ No ___ Specify: _____

   Are replicate results tabulated and available for review? Yes ___ No ___

5. Are such crosschecks used to validate or flag data?

   Yes ___ No ___ Indicate any cutoff points: _____

   _____

6. How are data finally reported? _____

   How often? _____ To whom? _____

   By whom? _____

7. Where and how are data archived? _____

   For how long? _____

8. What corrective actions are taken for out-of-control situations?

   _____

   _____

Figure F.2.0.7

Example of a Data and Record Keeping Questionnaire
(continued)

DATA AND RECORD KEEPING QUESTIONNAIRE
(continued)

9. How are data adjusted or deleted? _____

_____

_____

10. In what format and medium are the data submitted? _____

_____

_____

11. Are the procedures for data handling (i.e. validation, flagging, reporting and screening) documented in the standard operating procedures?

Yes ___ No ___

If not, where are the procedures documented? _____

12. Does each pollutant have a unique identification code?

Yes ___ No ___

13. Does each analysis method have a unique identification code?

Yes ___ No ___

Figure F.2.0.7

Example of a Data and Record Keeping Questionnaire
(continued)

DATA AND RECORD KEEPING QUESTIONNAIRE
(continued)

14. List the pollutant and method codes below.

Pollutant	Pollutant Code	Method Code

15. Are the data published? Yes ___ No ___ Frequency: _____

Provide an example of the published data.

Figure F.2.0.7

Example of a Data and Record Keeping Questionnaire
(continued)

QUALITY ASSURANCE QUESTIONNAIRE

1. Is there a defined quality assurance function ongoing within the network?

   Yes ___ No ___ Comment _____

2. Is this function independent of all routine operations?

   Yes ___ No ___ Comment _____

3. Does the individual responsible for this function regularly evaluate or audit the following operations?

   (a) Site operations (performance audits)? Yes ___ No ___

   Comment on frequency: _____

   (b) Site data? Yes ___ No ___

   Indicate percentage of data recalculated: _____

   (c) Analytical laboratory operations? Yes ___ No ___

   Indicate dates of last audits of lab: _____

   (d) Analytical laboratory data? Yes ___ No ___

   Indicate percentage of data recalculated: _____

4. Does quality assurance maintain (and/or prepare) independent check solutions or standards specifically used to monitor accuracy?

   Yes ___ No ___ Comment on types, concentrations and uses: _____

   _____

   _____

   _____

Figure F.2.0.8

Example of a Quality Assurance Questionnaire

QUALITY ASSURANCE QUESTIONNAIRE
(continued)

5. Does the quality assurance function include the use of EPA supplied check samples such as from interlaboratory surveys?

   Yes ___ No ___ Comment on frequency and analytes checked: _____

   _____

   _____

6. Does the analytical support lab participate in EPA, USGS and other interlaboratory round robin test programs?

   Yes ___ No ___ Comment on frequency and attach last results.

   Summary: _____

   _____

   _____

   _____

Figure F.2.0.8

Example of a Quality Assurance Questionnaire
(continued)

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FIELD OPERATIONS EVALUATION

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.3.0 FIELD OPERATIONS EVALUATION

F.3.0.1 Introduction - A field site systems audit is normally conducted in three steps. First a questionnaire is sent to the site prior to the audit visit. The site operator should then fill out the questionnaire through the use of attachments. Second, the questionnaire is reviewed by the auditor to become familiar with the system operations and to determine any weaknesses and potential problem areas. Third, after the questionnaire has been reviewed, the on site interviews are scheduled. The preliminary review of the questionnaire serves the purpose of allowing a greater amount of time to be spent on site examining potential problem areas.

The auditor should interview the site operator responsible for precipitation sample analysis, data validation and reporting. The information gathered from these interviews should be complete and up to date and should present an adequate picture of the current and proposed levels of implementation of all quality assurance activities, including internal quality control.

At the conclusion of the interview, the auditor should inform the site operator of the audit interview resu1ts and discuss any potential data impacting problems uncovered. This is commonly referred to as an exit interview. During this activity, the auditor also explains the reporting procedures and schedule.

F.3.0.2 General Guidance for Site Documentation - During the initial phase of network installation, each site should be documented using a site report form. This form should be completed by organization personnel to record station location, site classification, station instrumentation, topography and important pollution sources. This documentation should be updated at least annually thereafter, to reflect the changes that occur at the sites (i.e. construction of a new building).

It is important that the information contained on such site documentation be verified as accurate. While it does not fall within the scope of the quality assurance function to prepare these site documents, the Quality Assurance Officer should verify, for a small number of sites, that the information contained in such documents is accurate and complete. He/she should note any changes which may affect data quality and notify organization management of such problems. Of particular importance in this regard are sites where collocated instrumentation has been placed; such data may be used to estimate measurement or data precision.

F.3.0.3 Site Evaluation Reporting - At the conclusion of a site evaluation or evaluation of a group of sites for a single organization, the auditor should prepare a brief written report. This report should include at least a discussion of observations made during the site visit as noted in the questionnaire and a copy of the site documentation used for the evaluation. Where major discrepancies are noted, additional information needs to be included. If further documentation has been provided by the auditor, a newly completed accurate site description document should be attached. Recommendations to improve siting and thus the data quality obtained from the respective sites should be included.

F.3.0.4 Questionnaires - Figure F.3.0.1 and F.3.0.2 provide information on site documentation and field site evaluation.

SITE DOCUMENTATION REVIEW QUESTIONNAIRE

1. Site Address _____

   Designation (Number/Identifier) _____

2. Has the data acquisition objective changed?

   Yes ___ No ___ Comment _____

   _____

3. Verify the longitude and latitude by independently obtaining maps of the area.

   OK ___ Problem _____

4. Are the names, addresses and identification of responsible individuals still valid? If not, note changes:

   _____

   _____

5. Verify that all instrumentation is present and note any that are not operational. Give reason for non-operation and estimate of downtime. Is this a potential data impactor?

   Comment _____

   _____

6. Has additional equipment been added since the site documentation was prepared or equipment removed or changed? Add any changes to the equipment list:

   _____

   _____

   _____

Figure F.3.0.1

Example of a Site Documentation Review Questionnaire

SITE DOCUMENTATION REVIEW QUESTIONNAIRE
(continued)

7. If measurements are made at the site (or closely located site laboratory), verify the indicated information on type, model, description, etc., of pH and conductivity meters, balance, etc.

   OK ___ Problem _____

8. Is there a map indicating location and distances to the major sources which may affect data gathered at the site?

   Yes ___ No ___

9. Is the map still valid? Yes ___ No ___

   Or have the number and/or location of sources changed?

   _____

   Note problem areas: _____

10. Review sketch of map. Is it complete with respect to indication ofroadways, parking areas, buildings (including number of stories), tree lines, power lines, bodies of water, and fences?

    Complete _____ Incomplete (note problem areas) _____

    _____

    _____

11. Verify all distances using a tape measure or rule. Indicate significant discrepancies:

    _____

    _____

12. Walk around the site and compare view in the four cardinal directions with that as given in the site photos. If photos have not been included with the site documentation, the auditor should take at least one in each of the four cardinal directions (north, south, east and west) looking outward from the main sampler.

Figure F.3.0.1

Example of a Site Documentation Review Questionnaire
(continued)

SITE DOCUMENTATION REVIEW QUESTIONNAIRE
(continued)

13. Are there any obstacles with a height that subtends an angle of 30° with the ground horizontal from the center of the site that is not at least twice as far from the site as the obstacle is tall?

_____

14. Are the precipitation collectors and/or rain gauges at least 7 feet (2 meters) apart and no further than 15 meters apart?

Yes ___ No ___ Comment _____

15. Are rain gauge and precipitation collector placed in a line perpendicular or parallel to the prevailing wind, or in the direction specified for network sites? If parallel, is the wet bucket end upwind of the rest of the collector?

_____

_____

16. Is the rain gauge level?

Yes ___ No ___ Comment _____

17. Is the access door to the rain gauge on the leeward side of the wind path?

Yes ___ No ___ Comment _____

18. Is the rain gauge capable of measuring 0.01" (.025 cm) of precipitation?

Yes ___ No ___ Comment _____

19. Is the precipitation fall to the sites unobstructed? (The auditor should comment on vegetative obstructions such as trees which do not now pose any problems but which may impact precipitation within the next few years.)

_____

_____

_____

Figure F.3.0.1

Example of a Site Documentation Review Questionnaire
(continued)

SITE DOCUMENTATION REVIEW QUESTIONNAIRE
(continued)

20. For collocated precipitation collectors is the distance between them 7-45 feet (2-15 meters)?

Yes ___ No ___ Comment _____

_____

21. Will there be any changes made to the site or site equipment in the near future? Note the intended changes and schedule, and estimate any potential data impact (attach sheets as necessary).

_____

_____

_____

Figure F.3.0.1

Example of a Site Documentation Review Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE

This portion of the questionnaire concerns measurements made by field or support personnel independent of any measurements made by the analytical support laboratory. If some measurements are made only by the analytical lab, please mark only those applicable to the field operation.

This part of the questionnaire is to be repeated for each site visited during a program audit.

1. Standard Operating Procedures (SOPs)

   a. Has the organization written and implemented official Standard Operating Procedures?

      Yes ___ No ___ Comment _____

      Implementation Date: _____

   b. Is the SOP Manual followed in detail?

      Yes ___ No ___ Comment _____

   c. Does it contain all quality control steps practiced?

      Yes ___ No ___ Comment _____

   d. Does each analyst have a copy at his/her disposal?

      Yes ___ No ___ Comment _____

   e. Has an instrument performance study been completed for each analysis?

      Yes ___ No ___ Comment _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

2. Site Operator Training

   a. Is a formal training program used? Yes ___ No ___

      If yes, is it organization-wide? Yes ___ No ___

      In-house? Yes ___ No ___

      On-the-job training? Yes ___ No ___

3. Site address: _____

   Designation (number/identifier): _____

4. Does the agency have the necessary hand tools, electrical testing and calibration equipment to operate and maintain equipment, calibrate rain gauges and repair samplers at the site?

   Yes ___ No ___ Comment _____

5. For precipitation collection are the following types of equipment used?

   a. Automatic precipitation collectors? _____

   b. Bucket manual-type collectors? _____

   c. Recording rain gauges (sensitive to +0.01 in. (0.25 mm)? _____

   d. Event pen markers on rain gauges? _____

6. Are buckets cleaned at site? Yes ___ No ___

   Identify responsible person: _____

7. Does site have adequate supply of deionized water? Yes ___ No ___

   (Indicate source) and average conductivity (uS/cm): _____

   _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

8. Please indicate the types, makes and models of field measurement equipment (attach pages as necessary - not necessary if site documentation has been attached).

9. Are there an adequate number of clean buckets kept at the site?

   Yes ___ No ___ Indicate number usually on hand: _____

10. Is the collector sensor cleaned periodically with deionized water?

    Yes ___ No ___ How often? _____

11. For wet/dry collectors, is the rim of the dryfall bucket wiped clean regularly?

    Yes ___ No ___ How often? _____

12. Is the underside of the foam pad cleaned regularly?

    Yes ___ No ___ How often? _____

13. Is the rain sensor tested regularly?

    Yes ___ No ___ How often? _____

    By what method? _____

14. Is the dryfall bucket inspected for moisture at each site visit?

    Yes ___ No ___ How often? _____

15. Are rain gauge pens (weight trace and event) checked for ink?

    Yes ___ No ___ How often? _____

16. Is the rain gauge clock wound at prescribed intervals?

    Yes ___ No ___ Indicate interval: _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

17. Is the clock accurate to ± one-half hour per week?

Yes ___ No ___ Comment _____

18. Are bucket rinses peformed regularly according to standard operating procedures?

Yes ___ No ___ Comment _____

19. Indicate the frequency of calibrations for:

a. Rain gauge _____ per _____

b. pH meter _____ per _____

c. Conductivity meter _____ per _____

d. Balance for precipitation weighting _____ per _____

20. Are rain gauges calibrated:

a. upon installation? Yes ___ No ___

b. at least semi-annually? Yes ___ No ___

c. after major maintenance? Yes ___ No ___

d. when performance audits indicate the need? Yes ___ No ___

21. Is a conductivity standard solution kept at the site?

Yes ___ No ___ Indicate source: _____

Indicate concentration _____ umho/cm. Kept for how long? _____

22. Are the shelf life and accuracy of conductivity standards documented?

Yes ___ No ___ Comment _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

23. Is the conductivity meter calibrated under the same condition as used for the samples?

Yes ___ No ___ Comment _____

24. Is the conductivity meter calibrated with NBS traceable simulated precipitation reference solutions in addition to the calibration standard?

Yes ___ No ___ Frequency: _____

Source of reference solution: _____

Briefly outline procedure used to establish traceability: _____

_____

25. Are standard pH buffers kept at the site? Yes ___ No ___

pH 4 _____ (source) _____

pH 7 _____ (source) _____

Other _____ (source) _____

26. Is the pH meter calibrated with NBS traceable simulated precipitation reference solutions in addition to standard buffers?

Yes ___ No ___ Frequency: _____

Source of reference solutions: _____

Briefly outline procedure used to establish traceability: _____

_____

27. Is conductivity standard kept refrigerated when not in use?

Yes ___ No ___ Comment _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

28. Are pH and conductivity meter calibrations checked at least at one point immediately prior to sample measurement?

Yes ___ No ___ Briefly outline procedure: _____

_____

_____

_____

29. Is the sample temperature measured?

Yes ___ No ___ Indicate temperature range (^{o}C): _____

30. Where are measurement data recorded?

a. Site Logbook? _____

b. Data Sheet? _____

d. Other? _____

31. Are other check solutions maintained at the site?

Conductivity

level	source	frequency of use	shelf life
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

pH

level	source	frequency of use	shelf life
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

32. Is a check on the rain gauge calibration made regularly? _____

Yes ___ No ___ Indicate frequency: _____

33. Is the outside of the wet bucket wiped dry before weighing?

Yes ___ No ___ Comment _____

34. Is precipitation measured by weight? Yes ___ No ___

By volume? Yes ___ No ___

35. Has the balance used to weight precipitation been calibrated?

Yes ___ No ___ Frequency: _____

36. Has the balance calibration been performed with traceable weights?

Yes ___ No ___ Indicate traceability of weights: _____

37. Is balance zeroed before each use?

Yes ___ No ___ Comment _____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

38. How are pH and conductivity cells/electrodes stored between use?

pH	Conductivity
buffer (indicate pH) _____	conductivity standard _____
deionized water _____	deionized water _____
other _____	other _____

39. Are samples allowed to come to room temperature before measurements are made?

Yes ___ No ___ Comment _____

40. Are separate sample aliquots used for pH and conductivity?

Yes ___ No ___ If no, indicate which measurement is made first:

_____

41. Are aliquots discarded after use?

Yes ___ No ___ Comment _____

42. How are samples shipped to the lab? (Circle appropriate response)

In buckets	In bottles	In plastic bags
By air	By surface mail	By truck
With cold packs	At ambient temperature	

Comments _____

_____

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

FIELD SITE EVALUATION QUESTIONNAIRE
(continued)

43. Are samples shipped within 24 hours of collection? Yes ___ No ___

Briefly describe sample storage and treatment prior to shipment:

_____

_____

44. Do copies of field measurements accompany the sample? Yes ___ No ___

Are any additional copies made? Yes ___ No ___

How many: _____ Purpose: _____

_____

45. Do these records indicate (please attach an example data sheet if possible):

date of event	Yes ___ No ___
beginning and ending dates for cumulative sampling period	Yes ___ No ___
amount of precipitation	Yes ___ No ___
temperature	Yes ___ No ___
pH	Yes ___ No ___
conductivity	Yes ___ No ___
signature	Yes ___ No ___
additional comments	Yes ___ No ___

Figure F.3.0.2

Example of a Field Site Evaluation Questionnaire
(continued)

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME V

AUDIT PROCEDURES MANUAL

APPENDIX F.4.0

LABORATORY OPERATIONS EVALUATION

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.4.0 LABORATORY OPERATIONS EVALUATION

Each analytical support laboratory should be evaluated at least once each year to qualitatively assess the laboratory's ability to produce analytical data of high quality.

F.4.0.1 Procedure - A laboratory systems audit is normally conducted in three steps. First a questionnaire is sent to the analytical laboratory prior to the audit visit. The laboratory should then fill out the questionnaire as completely as possible and return it with sufficient documentation through the use of attachments. Second, the questionnaire is reviewed by the auditor to become familiar with the system operations and to determine any weaknesses and potential problem areas. Third, after the questionnaire has been reviewed, the on-site interviews are scheduled. The preliminary review of the questionnaire serves the purpose of allowing a greater amount of time to be spent on-site examining potential problem areas.

The auditor should interview the laboratory manager, any person who has direct analytical responsibility for precipitation sample analysis, personnel associated with data validation, analysis and reporting, and the person identified by the laboratory manager who has responsibility for quality assurance. The information gathered from these interviews should be complete and up to date and should present an adequate picture of the current and proposed levels of implementation of all quality assurance activities, including internal quality control.

At the conclusion of the series of interviews, the auditor should inform the laboratory manager of the audit interview results and discuss any potential data impacting problems uncovered. This is commonly referred to as an exit interview. During this activity, the auditor also explains the reporting procedures and schedule.

F.4.0.2 Laboratory Questionnaires - Figures F.4.0.1 through F.4.0.13 provide information on the analysis methods, standard laboratory operations, data entry, data bank validation, laboratory quality control, ion validation and laboratory management.

The data entry questionnaire should be completed by every person involved in the data entry and review process. The laboratory quality control questionnaire should be completed by every person responsible for the operation of an analytical instrument.

ANALYTICAL LABORATORY QUESTIONNAIRE

General Information

Questionnaire Completion Date _____

On-Site Visit Date _____

Laboratory: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Laboratory Phone No. (Area Code) (_____) _____

Organization Director: _____

Laboratory Director: _____

Quality Assurance Officer: _____

(Quality Control Chemist)

Questionnaire completed by (if more than one, please indicate which section(s) of the questionnaire completed):

_____

_____

On-Site Audit Conducted by: _____

_____

Affiliation of Auditor(s): _____

_____

Persons Present During Entrance Interview: _____

_____

Persons Present During Exit Interview: _____

_____

Figure F.4.0.1

Example of an Analytical Laboratory Questionnaire
General Information

GENERAL LABORATORY OPERATIONS QUESTIONNAIRE

1. Please use a simple block diagram to show the organization structure and how the laboratory functions within it.

2. Standard Operating Procedures (SOP)

   a. Has the organization written and implemented official Standard Operating Procedures?

      Yes ___ No ___ Comment _____

      Implementation Date: _____

   b. Is the SOP Manual followed in detail?

      Yes ___ No ___ Comment _____

   c. Does it contain all quality control steps practiced?

      Yes ___ No ___ Comment _____

   d. Does each analyst have a copy at his/her disposal?

      Yes ___ No ___ Comment _____

      Implementation Date: _____

   e. Has an instrument performance study been completed for each analysis?

      Yes ___ No ___ Comment _____

3. Please provide a complete list of laboratory personnel, their educational background, analytical experience in general and specific experience in precipitation sample analysis.

4. Laboratory Staff Training

   a. Is a formal training program used? Yes ___ No ___

      If yes, is it:

      Organization-wide? Yes ___ No ___

      In-house? Yes ___ No ___

      On-the-job training? Yes ___ No ___

Figure F.4.0.2

Example of a General Laboratory Operations Questionnaire

GENERAL LABORATORY OPERATIONS QUESTIONNAIRE
(continued)

5. Laboratory Facilities

Item	Available Yes	Available No	Comments (adequacy of facility and/or space)
1. Support Gas			
2. Lighting			
3. Compressed Air			
4. Vacuum Systems			
5. Electrical Services			
6. Hot and Cold Water			
7. Laboratory Sink			
8. Ventilation System			
9. Hood Space			
10. Cabinet Space			
11. Bench-top Area			
12. Lab Space			
13. Lab Space Utilized for Offices			
14. Office Space			
15. Storage Space			

Figure F.4.0.2

Example of a General Laboratory Operations Questionnaire
(continued)

GENERAL LABORATORY OPERATIONS QUESTIONNAIRE
(continued)

6. Laboratory Equipment

Item	No. of units	Equipment Make Model	Condition/ Age Good-Fair-Poor	% of Time In Rainwater Programs
Balance Analytical				
Vacuum Filtration Apparatus				
NBS Traceable Calibrated Thermometer				
Desiccator				
Ion Chromatograph				
Technicon				
Atomic Absorption				
Balance, Top Loader				
Class "S" Weights				
Balance table				
Distilled Water or Deionized Water				
Conductivity Meter				
Glassware				
pH Meter				
Drying Oven				
Hot Plates				
Refrigerator				

Figure F.4.0.2

Example of a General Laboratory Operations Questionnaire
(continued)

GRAVIMETRIC MEASUREMENT QUESTIONNAIRE

	Yes	No
1. Is the analytical balance calibrated daily with weights traceable to NBS?	___	___
2. Is a balance calibration log kept up to date?	___	___
3. Is routine factory service scheduled?	___	___

Date next service is due: _____

Figure F.4.0.3

Example of a Gravimetric Measurement Questionnaire

pH MEASUREMENT QUESTIONNAIRE

Analyst _____
(Name)

	Yes	No
1. Does the analyst have his/her own copy of the standard operating procedures?	___	___
2. Does the analyst have his/her own copy of instrument performance data?	___	___
3. Does the analyst have his/her own copy of safety instructions?	___	___
4. Does the analyst have his/her own copy of the latest monthly quality control plots?	___	___
5. Is the analyst aware of the most recent control limits?	___	___
6. Does the analyst have a copy of the most recent list of samples in-house to be analyzed?	___	___
Date of list _____		
7. Are all solutions properly labelled?	___	___
8. Has a pH meter/electrode acceptance test been completed and documented for the meter and electrode currently in use?	___	___
9. Is the pH electrode rinsed well before and after buffer and sample measurements?	___	___
10. Before and after samples are analyzed, is the pH meter and electrode calibration checked with NBS traceable simulated precipitation reference samples (low ionic strength)?	___	___

Figure F.4.0.4

Example of a pH Measurement Questionnaire

pH MEASUREMENT QUESTIONNAIRE
(continued)

		Yes	No
11.	Briefly outline the procedure used to establish traceability of the working standards to NBS.		
	_____		
	_____		
12.	Is the pH meter recalibrated after every set of twenty samples with a pH check sample?	___	___
13.	After the initial calibration of the day, when the meter is recalibrated after a series of measurements, is the old calibration information written down before the meter settings are changed?	___	___
14.	Is the pH electrode reference solution analyzed first and are the results compared to the pre-established control or warning limits?	___	___
15.	Are the following control samples analyzed with each run?		
	Distilled Water Blanks	___	___
	Old Samples	___	___
	QA Spike	___	___
16.	Are electrodes stored as recommended by the manufacturer?	___	___
17.	Are electrodes checked and filled, if necessary before each analysis?	___	___
18.	What corrective actions are taken for out-of-control situations?		
	_____		
	_____		

Figure F.4.0.4

Example of a pH Measurement Questionnaire
(continued)

pH MEASUREMENT QUESTIONNAIRE
(continued)

		Yes	No
19.	How are data adjusted or deleted?		
	_____		
	_____		
20.	Are replicate samples performed?	___	___
21.	Are the results of the replicate samples tabulated and available for review?	___	___
22.	How often are the replicate results provided to the Quality Assurance Section?		
	_____		
	In what format? _____		
23.	How often are the control charts provided to the Quality Assurance Section?		
	_____		
24.	How often are the results of the distilled water blanks, old samples and spike samples provided to the Quality Assurance Section?		
	_____		

Figure F.4.0.4

Example of a pH Measurement Questionnaire
(continued)

CONDUCTANCE MEASUREMENT QUESTIONNAIRE

Analyst _____
(Name)

	Yes	No
1. Does the analyst have his/her own copy of the standard operating procedures?	___	___
2. Does the analyst have his/her own copy of instrument performance data?	___	___
3. Does the analyst have his/her own copy of safety instructions?	___	___
4. Does the analyst have his/her own copy of the latest monthly quality control plots?	___	___
5. Is the analyst aware of the most recent control limits?	___	___
6. Does the analyst have a copy of samples in-house to be analyzed?	___	___
Date of list _____		
7. Are all solutions properly labelled?	___	___
8. Has a conductance meter/cell acceptance test been completed and documented for the meter and cell currently in use?	___	___
9. Is the conductance cell rinsed well before and after standard and sample measurements?	___	___
10. Before and after samples are analyzed, is the conductance meter and cell calibration checked with a NBS traceable simulated precipitation reference sample (low ionic strength)?	___	___

Figure F.4.0.5

Example of a Conductance Measurement Questionnaire

CONDUCTANCE MEASUREMENT QUESTIONNAIRE
(continued)

	Yes	No
11. Briefly outline the procedure used to establish traceability of the working standards to NBS.		
_____		
_____		
12. Is the conductance meter and cell calibration verified after every set of twenty samples with the conductivity check sample?	___	___
13. Is the conductance check sample analyzed first and are the results compared to the pre-established control or warning limits?	___	___
14. Are the following control samples analyzed with each run?		
Distilled Water Blanks	___	___
Old Samples	___	___
QA Spike	___	___
15. What corrective actions are taken for out-of-control situations?		
_____		
_____		
16. How are data adjusted or deleted?		
_____		
_____		
17. Are replicate samples performed?	___	___

Figure F.4.0.5

Example of a Conductance Measurement Questionnaire
(continued)

CONDUCTANCE MEASUREMENT QUESTIONNAIRE
(continued)

		Yes	No
18.	Are the results of the replicate samples tabulated and available for review?	___	___

19. How often are the replicate results provided to the Quality Assurance Section?

_____

In what format? _____

20. How often are the control charts provided to the Quality Assurance Section?

_____

21. How often are the results of the distilled water blanks, old samples and spike samples provided to the Quality Assurance Section?

_____

Figure F.4.0.5

Example of a Conductance Measurement Questionnaire
(continued)

AUTOMATED COLORIMETRY MEASUREMENT QUESTIONNAIRE

Analyst _____
(Name)

		Yes	No
1.	Does the analyst have his/her own copy of the standard operating procedures?	___	___
2.	Does the analyst have his/her own copy of instrument performance data?	___	___
3.	Does the analyst have his/her own copy of safety instructions?	___	___
4.	Does the analyst have his/her own copy of the latest monthly quality control plots?	___	___
5.	Is the analyst aware of the most recent control limits?	___	___
6.	Does the analyst have a copy of the most recent list of samples in-house to be analyzed?	___	___
	Date of list _____		
7.	Are all solutions properly labelled?	___	___
8.	Is a standard preparation form completed when new stock standards are prepared?	___	___
9.	Are dilute calibration standards prepared fresh daily?	___	___
10.	Is the analyst spike prepared fresh daily from an independent stock?	___	___
11.	Is the calibration curve at least a five point curve?	___	___
12.	Is the calibration verified using a NBS traceable simulated precipitation reference sample (low ionic strength)?	___	___

Figure F.4.0.6

Example of an Automated Colorimetry Measurement Questionnaire

AUTOMATED COLORIMETRY MEASUREMENT QUESTIONNAIRE
(continued)

	Yes	No
13. Briefly outline the procedure used to establish traceability of the working standards to NBS.		
_____		
_____		
14. Is the first calibration curve of the day checked for detection limit and linearity?	___	___
15. Are the analyst spike data calculated and plotted real time?	___	___
16. Is each new calibration curve checked to see that instrumental response changed less than 5%?	___	___
17. Are the following control samples analyzed with each run?		
Blanks	___	___
Old Samples	___	___
Analyst Spike	___	___

AUTOMATED COLORIMETRY MEASUREMENT QUESTIONNAIRE
(continued)

		Yes	No
24.	Is the colorimeter mirror assembly and color filter cleaned and the alignment optimized once per three months?	___	___
	Date of last service _____		
25.	What corrective actions are taken for out-of-control situations?		
	_____		
	_____		
26.	How are data adjusted or deleted?		
	_____		
	_____		
27.	Are replicate samples performed?	___	___
28.	Are the results of the replicate samples tabulated and available for review?	___	___
29.	How often are the replicate results provided to the Quality Assurance Section?		
	_____		
	In what format? _____		
30.	How often are the control charts provided to the Quality Assurance Section?		
	_____		
31.	How often are the results of the blanks, old samples, analyst spikes and QC spikes provided to the Quality Assurance Section?		
	_____		

Figure F.4.0.6

Example of an Automated Colorimetry Measurement Questionnaire
(continued)

ION CHROMATOGRAPHY ANALYSIS QUESTIONNAIRE

Analyst _____
(Name)

		Yes	No
1.	Does the analyst have his/her own copy of the standard operating procedures?	___	___
2.	Does the analyst have his/her own copy of instrument performance data?	___	___
3.	Does the analyst have his/her own copy of safety instructions?	___	___
4.	Does the analyst have his/her own copy of the latest monthly quality control plots?	___	___
5.	Is the analyst aware of the most recent control limits?	___	___
6.	Does the analyst have a copy of the most recent list of samples in-house to be analyzed?	___	___
	Date of list _____		
7.	Are all solutions properly labelled?	___	___
8.	Is a standard preparation form completed when new stock standards are prepared?	___	___
9.	Are dilute calibration standards prepared fresh daily?	___	___
10.	If manual techniques are used, are samples and eluent prepared fresh daily from the same concentrated stock buffer?	___	___
11.	Is the analyst spike prepared from an independent stock?	___	___
12.	Is the calibration curve at least a four point curve for each analytical range?	___	___

Figure F.4.0.7

Example of an Ion Chromatography Analysis Questionnaire

ION CHROMATOGRAPHY ANALYSIS QUESTIONNAIRE
(continued)

		Yes	No
13.	Is the first calibration curve of the day checked for detection limit and linearity?	___	___
14.	Is the calibration verified using a NBS traceable simulated precipitation reference sample (low ionic strength)?	___	___

15. Briefly outline the procedure used to establish traceability of the working standards to NBS.

_____

_____

16. What corrective actions are taken for out-of-control situations?

_____

_____

17. How are data adjusted or deleted?

_____

_____

18.	Are replicate samples performed?	___	___
19.	Are the results of the replicate samples tabulated and available for review?	___	___

20. How often are the replicate results provided to the Quality Assurance Section?

_____

In what format? _____

Figure F.4.0.7

Example of an Ion Chromatography Analysis Questionnaire
(continued)

ION CHROMATOGRAPHY ANALYSIS QUESTIONNAIRE
(continued)

		Yes	No
21.	How often are the control charts provided to the Quality Assurance Section?		
	_____		
22.	Are the present recoveries for the analyst spike data calculated in real time and compared to pre-established warning and control limits?	___	___
23.	Are the following control samples analyzed with each run?	___	___
	Blanks	___	___
	Old Samples	___	___
	Analyst Spikes	___	___
	QC Spike	___	___
24.	How often are the results of the blanks, old samples, analyst spikes and QC spikes provided to the Quality Assurance Section?		
	_____		
25.	Is the drip tray examined daily for reagent spills, and are spills cleaned up daily?	___	___
26.	Are pumps oiled once per week?	___	___
27.	Is the anion precolumn cleaned once per month with 0.1 M Na_2CO_3?	___	___
28.	Is the Br^-, NO_3^- resolution checked once a month and documented?	___	___

Figure F.4.0.7

Example of an Ion Chromatography Analysis Questionnaire
(continued)

ATOMIC ABSORPTION ANALYSIS QUESTIONNAIRE

Analyst _____
(Name)

		Yes	No
1.	Does the analyst have his/her own copy of the standard operating procedures?	___	___
2.	Does the analyst have his/her own copy of instrument performance data?	___	___
3.	Does the analyst have his/her own copy of safety instructions?	___	___
4.	Does the analyst have his/her own copy of the latest monthly quality control plots?	___	___
5.	Is the analyst aware of the most recent control limits?	___	___
6.	Does the analyst have a copy of the most recent list of samples in-house to be analyzed?	___	___
	Date of list _____		
7.	Are all solutions properly labelled?	___	___
8.	Is a standard preparation form completed when new stock standards are prepared?	___	___
9.	Are dilute calibration standards prepared fresh daily?	___	___
10.	Is the analyst spike prepared fresh daily from an independent stock?	___	___
11.	Is the instrument allowed to warm up at least 15 minutes with the flame on before the final wavelength adjustment is made?	___	___
12.	Is the calibration curve at least a five point curve?	___	___

Figure F.4.0.8

Example of an Atomic Absorption Analysis Questionnaire

ATOMIC ABSORPTION ANALYSIS QUESTIONNAIRE
(continued)

		Yes	No
13.	Is the first calibration curve of the day checked for detection limit and linearity?	___	___
14.	Is the calibration verified using a NBS traceable simulated precipitation reference sample (low ionic strength)?	___	___

15. Briefly outline the procedure used to establish traceability of the working standards to NBS.

_____

_____

16. What corrective actions are taken for out-of-control situations?

_____

_____

17. How are data adjusted or deleted?

_____

_____

18.	Are replicate samples performed?	___	___
19.	Are the results of the replicate samples tabulated and available for review?	___	___

20. How often are the replicate results provided to the Quality Assurance Section?

_____

In what format? _____

Figure F.4.0.8

Example of an Atomic Absorption Analysis Questionnaire
(continued)

ATOMIC ABSORPTION ANALYSIS QUESTIONNAIRE
(continued)

	Yes	No
21. How often are the control charts provided to the Quality Assurance Section?		
_____		
22. Are the analyst spike data calculated and plotted real time?	___	___
23. Is each new calibration curve checked to see that instrumental response changed less than 5%?	___	___
24. Are the following control samples analyzed with each run?	___	___
Blanks	___	___
Old Samples	___	___
Analyst Spikes	___	___
QC Spike	___	___
25. How often are the results of the blanks, old samples, analyst spikes and QC spikes provided to the Quality Assurance Section?		
_____		

Figure F.4.0.9

Example of an Atomic Absorption Analysis Questionnaire
(continued)

LABORATORY QUALITY CONTROL QUESTIONNAIRE

Quality Control Chemist _____
(Name)

		Yes	No
1.	Does the QC chemist have his/her own copy of the standard operating procedures?	___	___
2.	Does the QC chemist have his/her own copy of instrument performance data?	___	___
3.	Does the QC chemist have his/her own copy of safety instructions?	___	___
4.	Does the QC laboratory follow chain-of-custody procedures from sample receipt to discard?	___	___
5.	Are minimum detection limits calculated by an approved method or baseline standard deviation?	___	___
6.	Are calibration curve coefficients tabulated and regularly reviewed as evidence for instrumental control?	___	___
7.	Are all chemicals dated on receipt and discarded when shelf life is exceeded?	___	___
8.	Are all samples received by the laboratory logged into a bound notebook?	___	___
9.	Are all samples filtered before ion analysis?	___	___
10.	Are all samples stored in the refrigerator between analyses?	___	___
11.	Are all containers washed before they are sent to the field?	___	___
12.	Is the conductivity of the last rinse water measured for 1 out of 5 of the washed containers?	___	___
13.	Are the results of the rinses recorded, tabulated and sent to the Quality Assurance Section?	___	___

Figure F.4.0.9

Example of a Laboratory Quality Control Questionnaire

LABORATORY QUALITY CONTROL QUESTIONNAIRE
(continued)

		Yes	No
14.	If the conductivity of the rinse is greater than 2 uS/cm, is the container rinsed further?	___	___
15.	After the containers and lids are dried are the containers capped immediately?	___	___
16.	Are precautions taken not to touch the inside of the containers and lids?	___	___
17.	Are precautions taken not to breathe on the sample?	___	___
18.	After completion of the analyses, are the samples stored in a refrigerator for at least six months?	___	___
19.	Does the QC chemist have his/her own copy of the latest monthly quality control charts?	___	___
20.	Is the QC chemist aware of the most recent control limits for each analytical method?	___	___
21.	Does the QC chemist update control limits and obtain new control chart plots once per month?	___	___
22.	Does the QC chemist review the quality control data sheet and then decide whether or not to release data for reporting?	___	___
23.	Are the control charts submitted along with the analytical data to the lab manager and to the Quality Assurance Section?	___	___
24.	Are control charts, regression charts or computer QC data bases up to date and accessible?	___	___
25.	Does the QC chemist prepare check samples for the field sites?	___	___

Describe the sources of the samples. _____

_____

Figure F.4.0.9

Example of a Laboratory Quality Control Questionnaire
(continued)

LABORATORY QUALITY CONTROL QUESTIONNAIRE
(continued)

		Yes	No
26.	Does the QC chemist compare the laboratory and field data to the monthly check sample's value and report this to the laboratory manager?	___	___
27.	Does the QC chemist prepare and submit a blind QC spike once per month for each analytical method?	___	___
28.	Does the QC chemist routinely review and report blind QC spike data to the laboratory manager and the Quality Assurance Section?	___	___
29.	Are field data checked for reasonableness?	___	___
	Indicate what is checked: _____		
	_____		
	_____		
30.	Are rain gauge chart data for event times and amount checked?	___	___
31.	Are field data sheets filed in an organized manner?	___	___
32.	Are analytical lab data checked for reasonableness?	___	___
	Indicate what is checked: _____		
	_____		
	_____		
33.	Are a portion of data from the field reverified by lab (such as duplicate pH, conductivity or weight measurements)?	___	___
	Specify: _____		
34.	Are such crosschecks used to validate or flag data?	___	___
	Indicate any cutoff points: _____		

Figure F.4.0.9

Example of a Laboratory Quality Control Questionnaire
(continued)

LABORATORY QUALITY CONTROL QUESTIONNAIRE
(continued)

		Yes	No
35.	Do laboratory records include the following information?		
	a. Sample identification number	___	___
	b. Station identification	___	___
	c. Sample type	___	___
	d. Date sample received in laboratory	___	___
	e. Time, date and volume of collection	___	___
	f. Date of analysis	___	___
	g. Analyst	___	___
	h. Results of analysis (including raw analytical data)	___	___
	i. Recipient of the analytical data	___	___

36. Please indicate data sources and, as necessary, attach examples of, or briefly describe, the data format.

a. Field site/field lab data include:

rain gauge charts _____

copies of data sheets _____

copies of logbooks _____

other _____

b. Analytical lab data include:

analytical results _____

calibration data _____

separate QC data _____

Figure F.4.0.9

Example of a Laboratory Quality Control Questionnaire
(continued)

LABORATORY QUALITY CONTROL QUESTIONNAIRE
(continued)

	Yes	No
37. Are computer printouts and reports routinely spot checked against laboratory records before data are released?	___	___
38. What corrective actions are taken for out-of-control situations?		
_____		
_____		
_____		
39. How are data adjusted or deleted?		
_____		
_____		
_____		
40. Are the data for bucket rinses and blanks reported?	___	___
To whom? _____		
41. Are replicate samples performed?	___	___
42. Are the results of the replicate samples tabulated and available for review?	___	___
43. How often are data transmitted to the Air Quality Data Section?		
_____		
_____		
44. Who is responsible for data transmittal?		
_____		

Figure F.4.0.9

Example of a Laboratory Quality Control Questionnaire
(continued)

DATA ENTRY QUESTIONNAIRE

Data Entry Clerk _____
(Name)

	Yes	No
1. Does the data entry clerk do a 100% QC check for accuracy of data input into the computer?	___	___
2. Is output from computer checked with input data?	___	___
3. Do laboratory records include the following information?		
a. Sample identification number	___	___
b. Station identification	___	___
c. Sample type	___	___
d. Date sample received in laboratory	___	___
e. Time, date and volume of collection	___	___
f. Date of analysis	___	___
g. Analyst	___	___
h. Results of analysis (including raw analytical data)	___	___
i. Recipient of the analytical data	___	___

Figure F.4.0.10

Example of a Data Entry Questionnaire

DATA BANK VALIDATION QUESTIONNAIRE

Data Analyst _____
(Name)

	Yes	No
1. Please indicate data sources and, as necessary, attach examples of, or briefly describe, the data format.		
a. field site/field lab data include:		
rain gauge charts _____		
copies of data sheets _____		
copies of logbooks _____		
other _____		
b. analytical lab data include:		
analytical results _____		
calibration data _____		
separate QC data _____		
c. other data source used in conjunction with acid precipitation.		
meteorological data _____		
aerometric data _____		
source emission data _____		
2. Do laboratory records include the following information?		
a. Sample identification number	___	___
b. Station identification	___	___
c. Sample type	___	___
d. Date sample received in laboratory	___	___

Figure F.4.0.11

Example of a Data Bank Validation Questionnaire

DATA BANK VALIDATION QUESTIONNAIRE
(continued)

	Yes	No
e. Time, date and volume of collection	___	___
f. Date of analysis	___	___
g. Analyst	___	___
h. Results of analysis (including raw analytical data)	___	___
i. Recipient of the analytical data	___	___
3. Are field data sheets filed in an organized manner?	___	___

4. How are data finally reported?

_____

How often?

_____

By whom?

_____

5. Where and how are data archived?

For how long? _____

6. How are data adjusted or deleted?

_____

_____

_____

7. Are bucket rinse and filter blank data reported?	___	___

To whom? _____

Figure F.4.0.11

Example of a Data Bank Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE

1. Which of the following ion concentrations are normally used for the data validation analysis?

Cl^-	_____	H^+	_____
NO_3^-	_____	NH_4^+	_____
SO_4^{-2}	_____	Na^+	_____
PO_4^{-3}	_____	K^+	_____
HCO_3^-	_____	Mg^{+2}	_____
OH^-	_____	Ca^{+2}	_____

2. What additional ion concentrations are used for the data analysis?

_____

3. Which of the above ion concentrations are calculated from other concentrations?

_____

4. What equations are used to determine the calculated ion concentrations?

_____

5. Is the ion percent difference (I%d) calculated for each sample?

Yes ___ No ___

6. What equation is used to determine I%d?
(Let A = anion concentration, ueq/L and C = cation concentration; ueq/L.)

_____

Figure F.4.0.12

Example of an Ion Validation Questionnaire

ION VALIDATION QUESTIONNAIRE
(continued)

7. Is I%d calculated both for the field (using the field pH measurement) and for the laboratory (using the laboratory pH measurement)?

   Yes ___ No ___

8. Is I%d compared with a data base of historical I%d values?

   Yes ___ No ___

9. Is the I%d data base site-specific?

   Yes ___ No ___

10. Are the I%d pass/fail limits site-specific?

    Yes ___ No ___

11. Are the I%d pass/fail limits concentration-dependent?

    Yes ___ No ___

12. What are the I%d pass/fail limits?

A + C	I%d Pass Range

13. Is the conductance percent difference (C%d) calculated for each sample?

    Yes ___ No ___

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

14. What equation is used to determine C%d? (Let Calc = calculated conductar and Meas = measured conductance.)

_____

15. What factors are used to convert from concentration units, mg/L, to conductance units, uS/cm?

Cl^-	_____	H^+	_____
NO_3^-	_____	NH_4^+	_____
SO_4^{-2}	_____	Na^+	_____
PO_4^{-3}	_____	K^+	_____
HCO_3^-	_____	Mg^{+2}	_____
OH^-	_____	Ca^{+2}	_____

16. Is C%d calculated both for the field (using the field pH and conductance measurements) and for the laboratory (using the laboratory pH and conductance measurements)?

Yes ___ No ___

17. Is C%d compared with a data base of historical C%d values?

Yes ___ No ___

18. Is the C%d data base site-specific?

Yes ___ No ___

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

19. Are the C%d pass/fail limits site-specific?

Yes ___ No ___

20. Are the C%d pass/fail limits concentration-dependent?

Yes ___ No ___

21. What are the C%d pass/fail limits?

Measured Conductance	C%d Pass Range

22. For each sample, which of the following ion ratios are compared with normal ranges for various geographical, climatological and/or industrial/ nonindustrial areas?

Cl^-/Na^+ _____

Na^+/K^+ _____

Mg^{+2}/Ca^{+2} _____

NO_3^-/SO_4^{-2} _____

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

23. Are any other ion ratios compared with normal ranges for various geographical, climatological and/or industrial/nonindustrial areas?

Yes ___ No ___

Which ion ratios? _____

24. If the NO_3^-/SO_4^{-2} ratio is compared with inland and coastal norms, is SO_4^{-2} corrected for sea salt?

Yes ___ No ___

25. What equation is used to determine the sea salt correction?

_____

26. Is each site identified as to its geographical or climatological area such as arid, inland, coastal and/or industrial?

Yes ___ No ___

27. Are other intercomparisons made among the various ions?

Yes ___ No ___

28. Define the intercomparisons.

_____

_____

_____

_____

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

29. How are the field pH and conductance measurements compared with the corresponding laboratory measurements?

_____

30. Are the field vs. laboratory pH and conductances compared with a historical data base?

Yes ___ No ___

31. Are the field vs. laboratory pH and conductance measurement data bases site-specific?

Yes ___ No ___

32. Are the field vs. laboratory pH and conductance pass/fail limits site-specific?

Yes ___ No ___

33. Are the field vs. laboratory pH and conductance pass/fail limits concentration-dependent?

Yes ___ No ___

34. What are the (field-laboratory) pH pass/fail limits?

pH	(field/laboratory) pH Pass Range

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

35. What are the (field-laboratory) conductance pass/fail limits?

conductance	(field/laboratory) conductance Pass Range

36. Is the rain gauge measurement (inches) converted to a volume equivalent?

Yes ___ No ___

37. What factor is used to convert from the rain gauge measurement (inches) to the volume equivalent (mL)?

_____

38. Is the measured bucket volume compared to the rain gauge equivalent volume?

Yes ___ No ___

39. Is there a pass/fail range for the comparison between the measured bucket volume and the rain gauge equivalent volume?

Yes ___ No ___

40. Is the pass/fail range volume-dependent?

Yes ___ No ___

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

41. What is the pass/fail range?

_____

42. What type of data transformation is performed on the concentration data preparatory to performing the intercomparisons?

No transformation _____

Logarithmic transformation _____

Constant variance transformation _____

Other (specify) _____

43. Are the ion measurements compared with a data base of historical data?

Yes ___ No ___

44. Is the historical data base site-specific?

Yes ___ No ___

45. What sample data are excluded from the site-specific historical data base?

No data is excluded _____

Low volume (< _____ ml) samples are excluded

Outliers at the _____% level of significance are excluded

Other (specify) _____

A site-specific historical data base is not available _____

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

46. Are the intercomparisons involving SO_4^{-2} corrected for sea salt?

_____ Always

_____ Never

_____ Calculated both ways with final choice depending upon which gives higher correlations based on historical data

47. Are there site-specific pass/fail limits for the ion intercomparisons?

Yes ___ No ___

48. What statistical level of significance is used as a criterion for setting the pass/fail limits for laboratory reanalysis?

_____

49. What factors are taken into account in the statistical analysis for determining outliers?

Ion concentration ratio only _____

Ion concentration ratio and concentrations _____

Other _____

50. What corrective actions are taken for out-of-control situations?

_____

_____

51. How are data adjusted or deleted?

_____

_____

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

ION VALIDATION QUESTIONNAIRE
(continued)

52. Are bucket rinse and filter blank data considered when verifying ion concentrations?

Yes ___ No ___

Explain procedure. _____

_____

53. Are reports prepared on the number of reanalyses required based on ion validation procedures?

Yes ___ No ___

Are copies of the reports sent to the Quality Assurance Section?

Yes ___ No ___ Frequency _____

Figure F.4.0.12

Example of an Ion Validation Questionnaire
(continued)

LABORATORY MANAGEMENT QUESTIONNAIRE

Laboratory Manager _____
(Name)

	Yes	No
1. Does the laboratory manager have his/her own copy of the standard operating procedures?	___	___
2. Does the laboratory manager have his/her own copy of instrument performance data?	___	___
3. Does the laboratory manager have his/her own copy of safety instructions?	___	___
4. Does the laboratory manager have his/her own copy of the latest monthly quality control plots?	___	___
5. Is the laboratory manager aware of the most recent control limits?	___	___
6. Does the laboratory manager review the following before reporting data?	___	___
a. The data itself	___	___
b. The quality control data sheet with analyst notes	___	___
c. The quality control chemist QC reports	___	___
d. The ion summation ratios for the data	___	___
e. The calculated vs. measured sample conductivity	___	___
7. Does the laboratory manager ensure that at least 5% of the data have been checked independently by the QA Officer?	___	___
8. Does the laboratory manager ensure that all the necessary corrections have been implemented in the data base before release?	___	___
9. Does the laboratory manager ensure that the computer printouts and reports are routinely spot checked against laboratory records before data are released?	___	___

Figure F.4.0.13

Example of a Laboratory Management Questionnaire

STATE OF CALIFORNIA

AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME V

AUDIT PROCEDURES MANUAL

APPENDIX F.5.0

REFERENCES

MONITORING & LABORATORY DIVISION

JANUARY 1988

F.5.0 REFERENCES

1. Quality Assurance Handbook for Air Pollution Measurement Systems: Volume II, Ambient Air Specific Methods, Section 2.0.11, U.S. E.P.A., September 1985.

2. Quality Assurance Manual for Precipitation Measurement Systems, Environmental Monitoring Systems Laboratory, U.S. E.P.A., revised January 1985.

3. NADP Quality Assurance Plan Deposition Monitoring, WADP Quality Assurance Steering Committee, 1984.

4. Quality Assurance Manual (draft), Volume V, Audit Procedures Manual.